STATION PAPER NO. 102 • 1958

PRUNING ALLEGHENY HARDWOODS

W. D. Zeedyk
& A. F. Hough

Northeastern
Forest Experiment Station

Forest Service
U. S. Dept. Agriculture

W. D. ZEEDYK, *who took his B.S. degree in forestry at the University of New Hampshire in 1956, is a member of the Northeastern Forest Experiment Station's Division of Forest Economics Research. He served one field season in forest management research at the Allegheny Plateau Research Center under Mr. Hough.*

A. F. HOUGH *is a pioneer in U.S. Forest Service research on the Allegheny Plateau, having spent the last 30 years in studies of the ecology, silvics, silviculture, and management of the Allegheny hardwood-hemlock forest region of New York and Pennsylvania. He graduated from Syracuse University in 1923 and received his Master's degree at Yale in 1927. He is leader of the Northeastern Station's Allegheny Plateau Research Center at Kane, Pa.*

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THE continuing heavy demand for high-quality Allegheny hardwoods, particularly black cherry and sugar maple, impresses on us the need for more information about the responses of hardwoods to pruning. Pruning may have beneficial effects: it may increase quality without sacrificing growth. Or it may have detrimental effects: it may cause dieback of cambium, decay, staining and discoloration, gum formation, or other pathological and physiological reactions that reduce the quality of potential factory logs and veneer bolts. Better information about such effects should point the way to hardwood pruning methods that are beneficial both biologically and economically.

In 1937 a study was started on the Kane Experimental Forest in Elk County, Pennsylvania, to determine if detrimental effects of pruning might be avoided by leaving stubs rather than cutting flush. It had been suggested that leaving

Figure 1.--Examples of the two pruning methods used. Left, stub-pruning; notice the fairly long stubs left on the stem. Right, flush-pruning.

stubs might prevent the death of cambial tissue about the knot collars and the entrance of decay organisms through the pruning wound.

The study was designed to compare stub-pruning with conventional pruning techniques, with regard to their effects on healing and introduction of pathological and structural defects.

PRUNING METHODS

Two pruning techniques, flush-pruning and stub-pruning, were tested. In flush-pruning, all branches up to about 8 feet high on the bole were cut flush with the bole, using either garden-type pruning shears or a saw (fig. 1). Stub-pruning was done with shears only, leaving branch stubs 2 to 4 inches long.

These two techniques were applied in 1937 to a somewhat open 13-year-old stand of sugar maple, black cherry, and beech, with scattered yellow and sweet birch. Twenty-five trees each of sugar maple, beech, and cherry and a few birch were flush-pruned; an equal number were stub-pruned. Each tree was numbered, located on a map of the stand, its d.b.h. was measured, and the height of pruned branches was noted.

In 1956, nineteen years later, all pruned trees were remeasured for diameter growth, and a small sample of the chief species was selected for dissection. These sample trees--four maples, two beech, and two cherries--were carefully dissected and photographed to demonstrate gross features of interest. This small sample was selected for examination because it was felt that most of the treated trees should be left for future detailed study. Due to causes not associated with the pruning wounds, 49 percent of the birches died. Chief among these causes was suppression. All the surviving birches were spared for later study; none of these were dissected.

In choosing trees of the other three species for dissection, trees that had many pruned branches were selected rather than those showing the best form or growth. As a re-

sult, the beech specimens happened to be below average in size and vigor; the black cherry were about average;and both suppressed and vigorous sugar maples were dissected.

THE RESULTS

During the 19 years since establishment of this study, the crown cover has made a remarkable closure. This has been brought about by: (1) a spreading of the black cherry and the dominant crowns of other species, and (2) the persistence of the tolerant beech and sugar maple and their differentiation into the lower crown classes.

Though this study was not designed to determine the effect of pruning on growth of the individual tree or growth per acre, it is interesting to observe that all surviving trees have grown in height and their crowns have spread laterally to fill up formerly unoccupied growing space. The stand had been weeded in 1936-37 prior to this study.

Table 1.--Size and periodic increment of surviving pruned trees during period 1937-56

Species	Average d.b.h. 1937	Average d.b.h. 1956	Average 19-year increment	Average annual increment	Basis (Number of trees)
	Inches	Inches	Inches	Inches	
Beech	1.73	3.15	1.42	0.074	42
Sugar maple	1.55	3.87	2.32	0.122	45
Birch	2.04	6.77	4.73	0.249	18
Black cherry	2.56	8.98	6.42	0.338	48

Table 1 is presented as an example of the relative diameter growth of tree species in young Allegheny hardwood stands. The trees selected for pruning in 1937 were not crop trees in the usual sense. Thus their original size, crown position, and vigor may not have been superior, and subsequent diameter growth may be less than that of typical crop trees. Of the four species pruned, cherry made the

most rapid diameter growth. Beech was the slowest growing; the birches and sugar maple were intermediate.

Stub Pruning

The pruned stubs left on sugar maple and beech were very persistent and resistant to decay; small stubs were more durable than larger ones. Stubs an inch or more in diameter tended to become punky and insect-infested, but none of those studied served as a point of entrance for decay or staining of the bole.

Black cherry stubs decayed quickly and were riddled with insect burrows. Insect activity appeared to stimulate gum-streak formation and local staining in cherry. In all instances the stubs formed loose black knots, due to the death of the cambium in the branch.

Healing rate, or time until clear wood production began beyond the end of the stub, varied with length of stub and growth rate, species, and vigor. Healing was most rapid in black cherry, followed by sugar maple and beech. It is interesting to note that stubs persisted longer than the branches of naturally pruned controls, resulting in less clear wood than would have been produced had the trees not been pruned.

These preliminary results indicate that stub-pruning is an inferior method to use for any of the species dissected. Healing time is slow, and the stubs are persistent and likely to be infested by insects or attacked by fungi. Also, they form loose black knots. Table 2 gives the results for both stub- and flush-pruning, and figures 2 to 7 show conditions in representative trees before and after dissection in 1956.

Flush Pruning

Dieback of the cambium about the pruning wound did not occur on any of the three species dissected. Instead, the process of healing began at once, although the rate differed noticeably by species. Considerable discoloration and

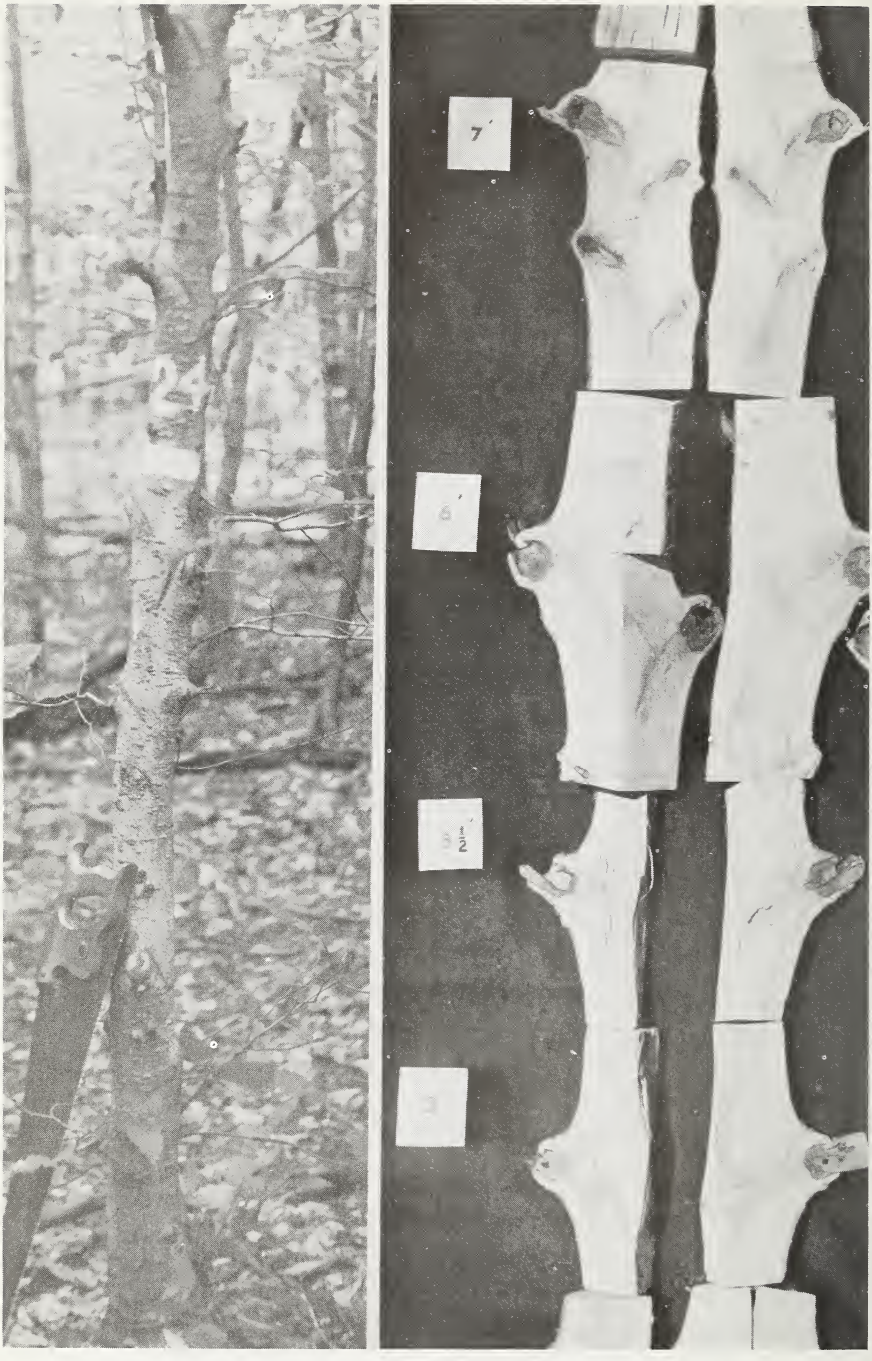

Figure 2.--Beech: stub-pruned.

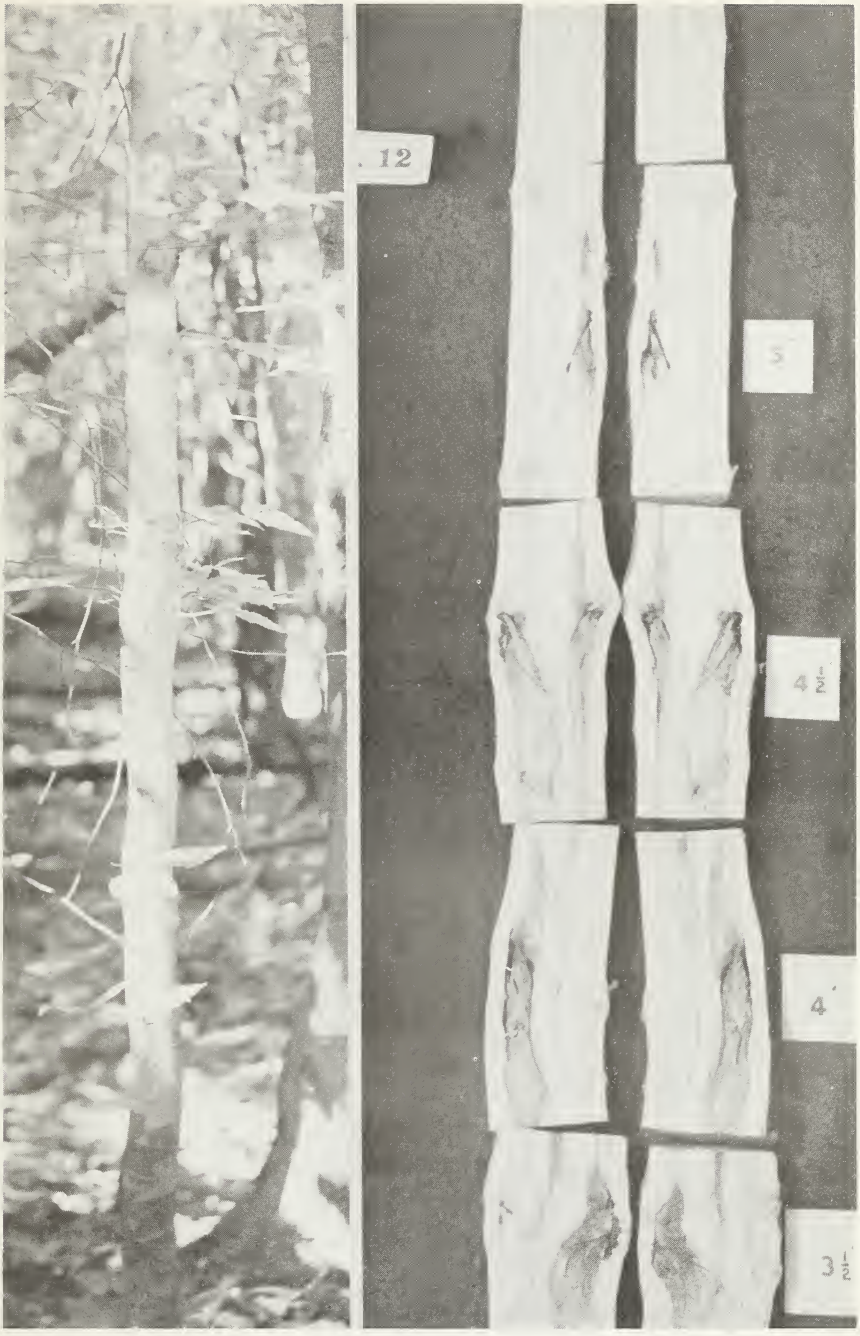

Figure 3.--Beech: flush-pruned.

Figure 4.--Sugar maple: stub-pruned.

Figure 5.--Sugar maple: flush-pruned.

Figure 6.--Black cherry: stub-pruned.

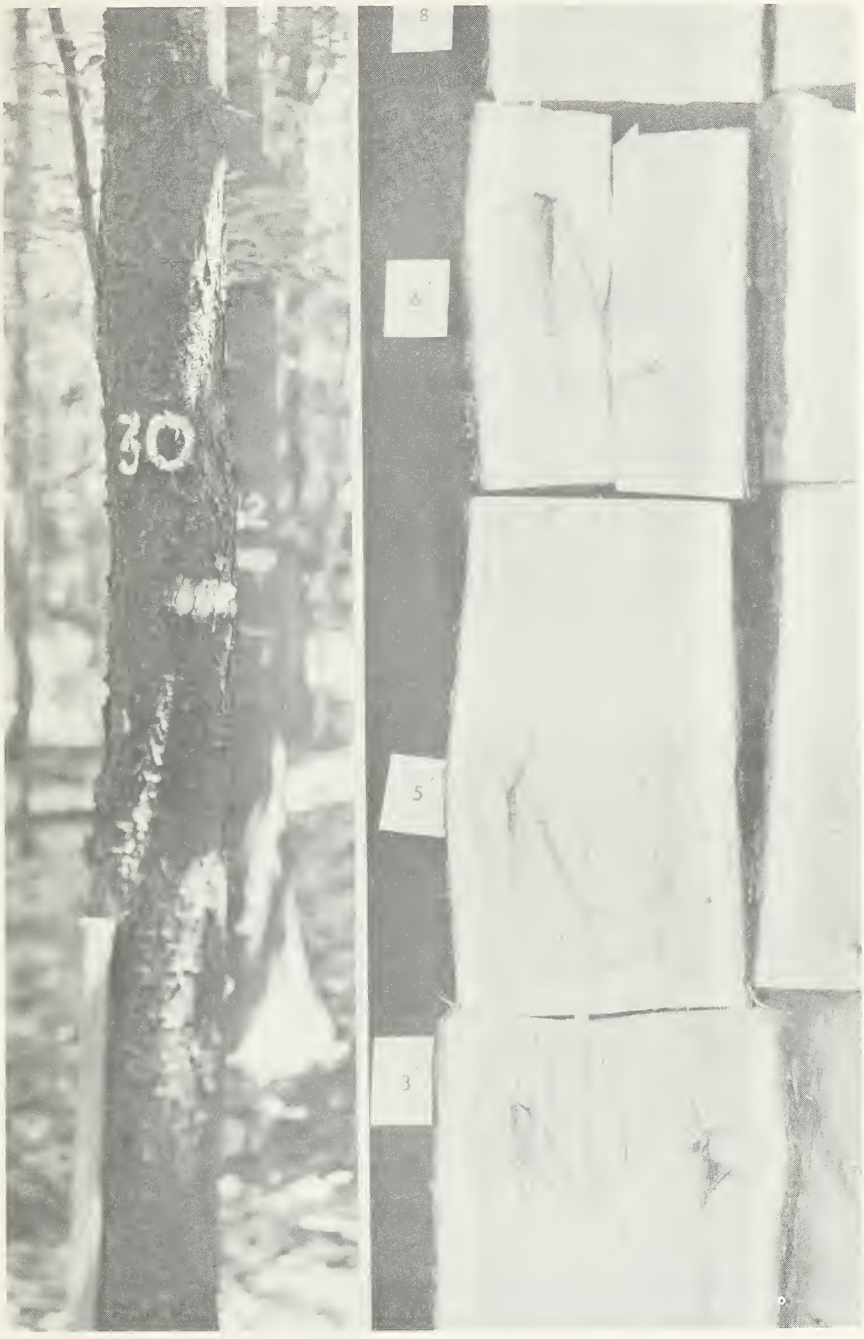

Figure 7.--Black cherry: flush-pruned.

decay did progress from the wound into the heartwood of suppressed beech and sugar maple. However, little or none of this occurred in black cherry or vigorous maple. This indicates that stubs need not be left to insure against cambial dieback, staining, or decay on maple and cherry crop trees. In other words, flush-pruning is preferable to stub-pruning.

Table 2.--Results of two pruning treatments on three Allegheny hardwoods

Species	Type of treatment	Healing time	Radial clearwood produced over wound	Nature of resulting defects
		Years	Inches	
Beech	Stub-pruned	8-19*	0-0.2	Stubs highly decayed but persisting. No staining or decay of bole.
	Flush-pruned	6	0.2-0.4	Knots decayed. Heartwood of bole stained and beginning to decay.
Sugar maple	Stub-pruned	9-19*	0-0.6	Stubs very persistent, forming loose black knots. Very little staining or decay in bole.
	Flush-pruned	2-3	0.6-1.4	Face of cuts decayed. Heartwood of bole stained and unsound except on vigorous trees.
Black cherry	Stub-pruned	6-9	0.8-0.9	Stubs less persistent than beech and maple but more insect-ridden. Form loose black knots and accompanied by gum streaks.
	Flush-pruned	Up to 5	1.4-1.5	Some staining of wound surface but knot and bole unstained and sound. Callus containing gum streaks in up to 3 annual rings beyond healing wound, but this is not a serious defect in pruned heart center.

*Some stubs still not healed over 19 years after treatment.

Healing was much more rapid with flush-pruning than with stub-pruning (table 2) but varied with species, vigor, and somewhat with branch height and diameter. Sugar maple required from 2 to 3 years for the wound to callus over; beech required about 6 years. All cherry wounds had callused

completely after 5 years but continued to show gum streaks and small bark inclusions for an additional 3 years. These are not serious defects when we consider that they are confined to the heart center.

Pruning And Epicormic Branching

Epicormic branching due to stimulation from pruning was not serious for either method tested. On beech, and to a less extent on sugar maple, a few small spur branches developed adjacent to the pruned limbs. More epicormic branching developed on the boles and in the crowns of sample trees damaged by glaze storms of 1936 and 1950 than developed from pruning wounds directly.

CONCLUSIONS AND RECOMMENDATIONS

The results of this preliminary study may be summarized as follows:

- Stub-pruning produced no desirable results and therefore it cannot be considered a sound pruning technique from any standpoint. However, the results of deliberately leaving stubs have served to show what can be expected if stubs are left by careless pruning and to reaffirm the need for close, carefully made severances when pruning hardwoods.

- Both stub-pruning and flush-pruning were particularly poor in the case of slow-growing, limby beech. Natural pruning is probably the only method for this relatively low-value species.

- Pruning of black cherry is very promising as a silvicultural treatment. Decay and defect after flush pruning are very slight, as compared with untreated trees; and healing and early production of clear wood proceed rapidly. Early pruning is recommended for vigorous potential crop trees in stands similar to that described above; and it can be expected to produce favorable results.

- Flush-pruning of vigorous selected crop trees of sugar maple, to remove relatively small limbs on the lower bole, can be done where necessary to improve quality. Little risk of decay entrance is expected in fast-growing vigorous trees. It is inadvisable to flush-prune slow-growing, low-vigor sugar maple; they have little future value unless released, and the chance of introducing stain and decay into the bole is rather great.

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